

# Course Outline

Transportation

REVISED: August/2017

**Job Title:**

Diesel Technician

**Career Pathway:**

Systems Diagnostics and Service

**Industry Sector:**

Transportation

**O\*NET-SOC CODE:**

49-3031.00

**CBEDS Title:**

Diesel Equipment Mechanics

**CBEDS No.:**

5657

**79-90-55**

**Auto Tech: Diesel/1**

**Credits:** 15

**Hours:** 180

**Course Description:**

This competency-based course is one in a sequence of three courses designed to meet the Automotive Service Excellence (ASE) Program Certification Standards set by the National Automotive Technicians Education Foundation (NATEF). It provides students with technical instruction and practical experience with diesel engines incorporating sustainable and green vehicle technologies. Instruction includes classroom and workplace policies and procedures in accordance with federal, state, and local safety and environmental regulations. It covers the proper use, maintenance, and storage of diesel repair tools and equipment as well as the effective use of service manuals and computer-based information systems. Emphasis is placed on the techniques in the following areas of diesel engine diagnosis and repair: general, cylinder head and valve train, and engine block. It also teaches trade mathematics, resource management, and employability skills. The competencies in this course are aligned with the California High School Academic Content Standards and the California Career Technical Education Model Curriculum Standards.

**Prerequisites:**

Enrollment requires successful completion of the Auto Tech: Engine Repair (79-90-73) course.

**NOTE:** For Perkins purposes this course has been designated as a **introductory/concentrator** course.

Meets NATEF Standards and identifies priority tasks in medium/heavy truck diesel engine. Check the NATEF Manual for explanation of priority 1, 2, or 3 tasks.

This course cannot be repeated once a student receives a Certificate of Completion.



## **COURSE OUTLINE COMPETENCY-BASED COMPONENTS**

A course outline reflects the essential intent and content of the course described. Acceptable course outlines have six components. (Education Code Section 52506). Course outlines for all apportionment classes, including those in jails, state hospitals, and convalescent hospitals, contain the six required elements:

(EC 52504; 5CCR 10508 [b]; Adult Education Handbook for California [1977], Section 100)

### **COURSE OUTLINE COMPONENTS**

### **LOCATION**

#### **GOALS AND PURPOSES**

Cover

The educational goals or purposes of every course are clearly stated and the class periods are devoted to instruction. The course should be broad enough in scope and should have sufficient educational worth to justify the expenditure of public funds.

The goals and purpose of a course are stated in the COURSE DESCRIPTION. Course descriptions state the major emphasis and content of a course, and are written to be understandable by a prospective student.

#### **PERFORMANCE OBJECTIVES OR COMPETENCIES**

pp. 7-15

Objectives should be delineated and described in terms of measurable results for the student and include the possible ways in which the objectives contribute to the student's acquisition of skills and competencies.

Performance Objectives are sequentially listed in the COMPETENCY-BASED COMPONENTS section of the course outline. Competency Areas are units of instruction based on related competencies. Competency Statements are competency area goals that together define the framework and purpose of a course. Competencies fall on a continuum between goals and performance objectives and denote the outcome of instruction.

Competency-based instruction tells a student before instruction what skills or knowledge they will demonstrate after instruction. Competency-based education provides instruction which enables each student to attain individual goals as measured against pre-stated standards.

Competency-based instruction provides immediate and continual repetition and In competency-based education the curriculum, instruction, and assessment share common characteristics based on clearly stated competencies. Curriculum, instruction and assessment in competency-based education are: explicit, known, agreed upon, integrated, performance oriented, and adaptive.

**COURSE OUTLINE COMPETENCY-BASED COMPONENTS**  
**(continued)**

<b>COURSE OUTLINE COMPONENTS</b>	<b>LOCATION</b>
<b>INSTRUCTIONAL STRATEGIES</b>	p. 18
Instructional techniques or methods could include laboratory techniques, lecture method, small-group discussion, grouping plans, and other strategies used in the classroom.	
Instructional strategies for this course are listed in the TEACHING STRATEGIES AND EVALUATION section of the course outline. Instructional strategies and activities for a course should be selected so that the overall teaching approach takes into account the instructional standards of a particular program, i.e., English as a Second Language, Programs for Adults with Disabilities.	
<b>UNITS OF STUDY, WITH APPROXIMATE HOURS ALLOTTED FOR EACH UNIT</b>	Cover
The approximate time devoted to each instructional unit within the course, as well as the total hours for the course, is indicated. The time in class is consistent with the needs of the student, and the length of the class should be that it ensures the student will learn at an optimum level.	
Units of study, with approximate hours allotted for each unit are listed in the COMPETENCY AREA STATEMENT(S) of the course outline. The total hours of the course, including work-based learning hours (community classroom and cooperative vocational education) is listed on the cover of every CBE course outline. Each Competency Area listed within a CBE outline is assigned hours of instruction per unit.	
<b>EVALUATION PROCEDURES</b>	pp. 18-19
The evaluation describes measurable evaluation criteria clearly within the reach of the student. The evaluation indicates anticipated improvement in performances as well as anticipated skills and competencies to be achieved.	
Evaluation procedures are detailed in the TEACHING STRATEGIES AND EVALUATION section of the course outline. Instructors monitor students' progress on a continuing basis, assessing students on attainment of objectives identified in the course outline through a variety of formal and informal tests (applied performance procedures, observations, and simulations), paper and pencil exams, and standardized tests.	
<b>REPETITION POLICY THAT PREVENTS PERPETUATION OF STUDENT ENROLLMENT</b>	Cover
After a student has completed all the objectives of the course, he or she should not be allowed to reenroll in the course. There is, therefore, a need for a statement about the conditions for possible repetition of a course to prevent perpetuation of students in a particular program for an indefinite period of time.	

## **ACKNOWLEDGMENTS**

Thanks to PAUL PIDOUX and MARCELA BAKER for developing and editing this curriculum. Acknowledgment is also given to ERICA ROSARIO for designing the original artwork for the course covers.

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# **CALIFORNIA CAREER TECHNICAL EDUCATION MODEL CURRICULUM STANDARDS**

## ***Transportation Industry Sector Knowledge and Performance Anchor Standards***

### **1.0 Academics**

Analyze and apply appropriate academic standards required for successful industry sector pathway completion leading to postsecondary education and employment. Refer to the Transportation academic alignment matrix for identification of standards.

### **2.0 Communications**

Acquire and accurately use Transportation sector terminology and protocols at the career and college readiness level for communicating effectively in oral, written, and multimedia formats.

### **3.0 Career Planning and Management**

Integrate multiple sources of career information from diverse formats to make informed career decisions, solve problems, and manage personal career plans.

### **4.0 Technology**

Use existing and emerging technology to investigate, research, and produce products and services, including new information, as required in the Transportation sector workplace environment.

### **5.0 Problem Solving and Critical Thinking**

Conduct short, as well as more sustained, research to create alternative solutions to answer a question or solve a problem unique to the Transportation sector using critical and creative thinking, logical reasoning, analysis, inquiry, and problem-solving techniques.

### **6.0 Health and Safety**

Demonstrate health and safety procedures, regulations, and personal health practices and determine the meaning of symbols, key terms, and domain-specific words and phrases as related to the Transportation sector workplace environment.

### **7.0 Responsibility and Flexibility**

Initiate, and participate in, a range of collaborations demonstrating behaviors that reflect personal and professional responsibility, flexibility, and respect in the Transportation sector workplace environment and community settings.

### **8.0 Ethics and Legal Responsibilities**

Practice professional, ethical, and legal behavior, responding thoughtfully to diverse perspectives and resolving contradictions when possible, consistent with applicable laws, regulations, and organizational norms.

### **9.0 Leadership and Teamwork**

Work with peers to promote divergent and creative perspectives, effective leadership, group dynamics, team and individual decision making, benefits of workforce diversity, and conflict resolution as practiced in the SkillsUSA career technical student organization

### **10.0 Technical Knowledge and Skills**

Apply essential technical knowledge and skills common to all pathways in the Transportation sector, following procedures when carrying out experiments or performing technical tasks.

### **11.0 Demonstration and Application**

Demonstrate and apply the knowledge and skills contained in the Transportation anchor standards, pathway standards, and performance indicators in classroom, laboratory, and workplace settings, and through the SkillsUSA career technical student organization.

## **Transportation Pathway Standards**

### **C. Systems Diagnostics and Service Pathway**

The Systems Diagnostics and Service pathway prepares students for postsecondary education and employment in the transportation industry, which includes but is not limited to motor vehicles, rail systems, marine applications, and small-engine and specialty equipment.

Sample occupations associated with this pathway:

- ◆ Service Technician/Maintenance Worker/Shop Foreman
- ◆ Technical Writer
- ◆ Dispatcher
- ◆ Engineer
- ◆ Investigator/Inspector

- C1.0 Demonstrate the practice of personal and occupational safety and protecting the environment by using materials and processes in accordance with manufacturer and industry standards.
- C2.0 Practice the safe and appropriate use of tools, equipment, and work processes.
- C3.0 Use scientific principles in relation to chemical, mechanical, and physical functions for various engine and vehicle systems.
- C4.0 Perform and document maintenance procedures in accordance with the recommendations of the manufacturer.
- C5.0 Apply and understand appropriate business practices.
- C6.0 Demonstrate the application, operation, maintenance, and diagnosis of engines, including but not limited to two- and four-stroke and supporting subsystems.
- C7.0 Demonstrate the function, principles, and operation of electrical and electronic systems using manufacturer and industry standards.
- C8.0 Demonstrate the function and principles of automotive drivetrain, steering and suspension, brake, and tire and wheel components and systems in accordance with national industry standards.

**CBE**  
**Competency-Based Education**

**COMPETENCY-BASED COMPONENTS**  
**for the Auto Tech: Diesel/1 Course**

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
<p>A. ORIENTATION AND SAFETY</p> <p>Understand, apply, and evaluate classroom and workplace policies and procedures used in accordance with federal, state, and local safety and environmental regulations.</p> <p>(5 hours)</p>	<ol style="list-style-type: none"> <li>1. Describe the scope and purpose of the course.</li> <li>2. Describe classroom policies and procedures.</li> <li>3. Identify classroom and workplace first aid and emergency procedures.</li> <li>4. Describe the different occupations in the Transportation Industry Sector which have an impact on the role of the diesel technician.</li> <li>5. Describe the California Occupational Safety and Health Administration (Cal/OSHA) workplace requirements for diesel technicians.</li> <li>6. Explain the impact of Environmental Protection Agency (EPA) legislation on Transportation Industry Sector practices in protecting and preserving the environment.</li> <li>7. Explain the impact of California Air Resources Board (ARB) legislation on Transportation Industry Sector practices in protecting and preserving the environment.</li> <li>8. State the Bureau of Automotive Repair (BAR) standards for safety and environmental protection.</li> <li>9. Describe and demonstrate the use of the Material Safety Data Sheet (MSDS) as it applies to the diesel industry.</li> <li>10. Identify the safety items required by federal, state, and local regulations.</li> <li>11. Describe the role of the National Automotive Technicians Education Foundation (NATEF) in diesel technician training.</li> <li>12. Describe and demonstrate the NATEF standards regarding proper use of protective clothing and gloves in a diesel shop.</li> <li>13. Describe and demonstrate the NATEF standards regarding proper use of protective respiratory gear in a diesel shop.</li> <li>14. Describe and demonstrate the NATEF standards regarding proper use of protective eye gear in a diesel shop.</li> <li>15. Describe and demonstrate the NATEF standards regarding proper ventilation in a diesel shop.</li> <li>16. Describe and demonstrate NATEF standards regarding proper handling, storage, and disposal of chemicals and materials used in a diesel shop.</li> <li>17. Pass the safety exam with 100% accuracy.</li> </ol>	<p><b>Career Ready Practice:</b> 1, 3, 6, 7</p> <p><b>CTE Anchor:</b> Health and Safety: 6.1, 6.3, 6.5, 6.6, 6.7 Ethics and Legal Responsibilities: 8.2 Demonstration and Application: 11.2</p> <p><b>CTE Pathway:</b> C1.2, C1.3, C1.4, C5.2</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
<p><b>B. RESOURCE MANAGEMENT</b></p> <p>Understand, apply, and evaluate the resource management principles and techniques in the diesel repair and maintenance business.</p> <p>(1 hour)</p>	<ol style="list-style-type: none"> <li>1. Define the following:               <ol style="list-style-type: none"> <li>a. resources</li> <li>b. management</li> <li>c. sustainability</li> </ol> </li> <li>2. Describe the management of the following resources in the diesel repair and maintenance business:               <ol style="list-style-type: none"> <li>a. time</li> <li>b. materials</li> <li>c. personnel</li> </ol> </li> <li>3. List specific examples of effective management of the following in the diesel repair and maintenance business:               <ol style="list-style-type: none"> <li>a. time</li> <li>b. materials</li> <li>c. personnel</li> </ol> </li> <li>4. Describe the benefits of effective resource management in the diesel repair and maintenance business:               <ol style="list-style-type: none"> <li>a. profitability</li> <li>b. sustainability</li> <li>c. company growth</li> </ol> </li> <li>5. Describe the economic benefits and liabilities of managing resources in an environmentally responsible way.</li> </ol>	<p><b>Career Ready Practice:</b> 1, 2, 3, 5, 8</p> <p><b>CTE Anchor:</b> Responsibility and Flexibility: 7.1, 7.4, 7.6</p> <p><b>CTE Pathway:</b> C5.3</p>
<p><b>C. TRADE MATHEMATICS</b></p> <p>Understand, apply, and evaluate the mathematical requirements used in diesel repair and maintenance.</p>	<ol style="list-style-type: none"> <li>1. Identify the practical applications of math in diesel technology.</li> <li>2. Describe and demonstrate problem-solving techniques involving whole number problems, using addition, subtraction, multiplication, and division.</li> <li>3. Describe and demonstrate problem-solving techniques involving various fraction problems, using arithmetic operations (addition, subtraction, multiplication, and division).</li> <li>4. Describe and demonstrate problem-solving techniques involving various decimal problems, using arithmetic operations.</li> <li>5. Describe and demonstrate techniques for changing fractions to decimals.</li> <li>6. Describe and demonstrate techniques for changing decimals to fractions.</li> <li>7. Describe the English system of measuring length.</li> <li>8. Describe the English system of measuring weight.</li> <li>9. Describe the English system of measuring volume or capacity.</li> <li>10. Describe the relationships between various English system linear units of measurement, such as inches, feet, yards, and miles.</li> <li>11. Describe the relationships between various English system units of volume or capacity, such as cups, pints, quarts, and gallons.</li> </ol>	<p><b>Career Ready Practice:</b> 1, 5</p> <p><b>CTE Anchor:</b> Problem Solving and Critical Thinking: 5.2, 5.3</p> <p><b>CTE Pathway:</b> C2.4, C2.7</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(10 hours)	<ol style="list-style-type: none"> <li>12. Describe and demonstrate problem-solving techniques for various English system measuring problems, using arithmetic operations.</li> <li>13. Describe and demonstrate measuring techniques of various objects by using the English system measuring tools common to the trade.</li> <li>14. Describe the metric system of measuring length.</li> <li>15. Describe the metric system of measuring weight.</li> <li>16. Describe the metric system of measuring volume or capacity.</li> <li>17. Describe the relationships between various metric system linear units of measurement, such as millimeters, centimeters, and meters.</li> <li>18. Describe the relationships between various metric system units of weight such as milligrams, grams, and kilograms.</li> <li>19. Describe and demonstrate problem-solving techniques for various metric system measuring problems involving addition, subtraction, multiplication, and division.</li> <li>20. Describe and demonstrate measuring techniques of objects using metric system measuring tools common to the trade.</li> <li>21. Describe and demonstrate problem-solving techniques for geometric problems that apply to diesel repair and maintenance.</li> <li>22. Describe and demonstrate problem-solving techniques for algebraic problems that apply to diesel repair and maintenance.</li> <li>23. Describe and demonstrate problem-solving techniques using percentages.</li> <li>24. Describe and demonstrate techniques for reading and interpreting graphs.</li> <li>25. Describe and demonstrate techniques for using a calculator.</li> </ol>	
<p>D. SERVICE MANUALS AND COMPUTER-BASED INFORMATION SYSTEMS</p> <p>Understand, apply, and evaluate the contents of service manuals and computer-based information systems as important sources of reference to a diesel technician.</p> <p>(3 hours)</p>	<ol style="list-style-type: none"> <li>1. Describe the different types of service manuals.</li> <li>2. Describe the different types of information that can be found in service manuals such as specifications, troubleshooting charts, and repair information.</li> <li>3. Describe and demonstrate the use of service manuals.</li> <li>4. Describe and demonstrate the use of CD-ROM (compact disc) and web-based search engines in finding diesel technical information.</li> <li>5. Describe the advantages of using CD-ROM and web-based search engines over service manuals in finding diesel technical information.</li> </ol>	<p><b>Career Ready Practice:</b> 1, 11</p> <p><b>CTE Anchor:</b> Communications: 2.3 Technology: 4.1, 4.2, 4.6</p> <p><b>CTE Pathway:</b> C2.6, C4.3</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
<p>E. TOOLS AND EQUIPMENT</p> <p>Understand, apply, and evaluate the policies and procedures for using diesel tools and equipment in accordance with federal, state, and local safety and environment regulations.</p> <p>(10 hours)</p>	<ol style="list-style-type: none"> <li>1. Identify and demonstrate the proper use, maintenance, and storage techniques for the general shop hand tools.</li> <li>2. Identify and demonstrate the proper use, maintenance, and storage techniques for the general shop equipment.</li> <li>3. Identify and demonstrate the proper use, maintenance, and storage techniques for the following specialty tools and equipment for diesel engines:               <ol style="list-style-type: none"> <li>a. connector pick tool set</li> <li>b. ball/small hole gauges</li> <li>c. cooling system vacuum fill machine (optional)</li> <li>d. dial bore gauge or telescoping gauges</li> <li>e. engine stands</li> <li>f. fan hub wrenches</li> <li>g. injector removal tool(s)</li> <li>h. liner installer (universal)</li> <li>i. liner puller (universal)</li> <li>j. manometer - (water) or magnehelic gauge</li> <li>k. precision straight edge</li> <li>l. protrusion gauge (cylinder liner height)</li> <li>m. ring compressor</li> <li>n. ring expander(s)</li> <li>o. rod bolt protectors</li> <li>p. soft jaw vise or adapters</li> <li>q. valve spring compressor</li> <li>r. vibration damper puller</li> </ol> </li> <li>4. Identify and demonstrate the proper use, maintenance, and storage techniques for the following specialty tools and equipment for diesel preventive maintenance:               <ol style="list-style-type: none"> <li>a. fifth wheel test pin</li> <li>b. stop watch</li> <li>c. tire square</li> <li>d. trailer cord tester</li> </ol> </li> <li>5. Identify and demonstrate the proper use, maintenance, and storage techniques for the following engine diagnostic-testing instruments:               <ol style="list-style-type: none"> <li>a. tachometer</li> <li>b. compression tester</li> <li>c. cylinder leakage tester</li> <li>d. engine vacuum gauge</li> </ol> </li> </ol>	<p><b>Career Ready Practice:</b> 1, 3, 10</p> <p><b>CTE Anchor:</b> Health and Safety: 6.3</p> <p><b>CTE Pathway:</b> C2.2, C2.3</p>
<p>F. BASIC PRINCIPLES OF DIESEL</p> <p>Understand and evaluate the basic principles of diesel operation and fuel.</p>	<ol style="list-style-type: none"> <li>1. Explain diesel theory.</li> <li>2. Identify characteristics of diesel fuel.</li> <li>3. Describe various combustion chamber designs.</li> <li>4. Describe the different types of fuel supply systems.</li> <li>5. Describe low-pressure supply pump operation.</li> <li>6. Explain the significance of fuel injection timing.</li> <li>7. Explain nozzle spray patterns.</li> <li>8. Compare pump injection to nozzle injection</li> </ol>	<p><b>Career Ready Practice:</b> 1, 4, 11</p> <p><b>CTE Anchor:</b> Problem Solving and Critical Thinking: 5.3</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(5 hours)		Technical Knowledge and Skills: 10.1  <b>CTE Pathway:</b> C1.5, C3.1, C3.6
<b>G. BOSCH FUEL INJECTION SYSTEM</b>  Understand, apply, and evaluate the operation and testing techniques for the Bosch Fuel Injection System.	<ol style="list-style-type: none"> <li>1. Describe the Bosch HPF injection pump operation.</li> <li>2. Identify components of the HPF pump.</li> <li>3. Disassemble a HPF pump.</li> <li>4. Describe the pump drive.</li> <li>5. Identify Bosch injection nozzles.</li> <li>6. Identify nozzle holders.</li> <li>7. Identify single plunger fuel-injection (PF) series pumps.</li> <li>8. Explain governing of a PF pump.</li> <li>9. Explain timing techniques for the Bosch Fuel Injection System.</li> </ol>	<b>Career Ready Practice:</b> 1, 4, 11  <b>CTE Anchor:</b> Problem Solving and Critical Thinking: 5.3 Technical Knowledge and Skills: 10.1  <b>CTE Pathway:</b> C1.5, C3.1, C3.6
<b>H. GENERAL MOTORS FUEL INJECTION SYSTEM</b>  Understand, apply, and evaluate the operation and testing techniques for GM Fuel Injection Systems.	<ol style="list-style-type: none"> <li>1. Describe GM Fuel Supply Systems.</li> <li>2. Explain the operation of a GM fuel supply pump.</li> <li>3. Describe GM injections.</li> <li>4. Describe performance problems related to GM injection systems.</li> </ol>	<b>Ready Practice:</b> 1, 4, 11  <b>CTE Anchor:</b> Problem Solving and Critical Thinking: 5.3 Technical Knowledge and Skills: 10.1  <b>CTE Pathway:</b> C1.5, C3.1, C3.6

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
<p>I. LUCAS CAV FUEL INJECTION SYSTEM</p> <p>Understand, apply, and evaluate the operation and testing techniques for Lucas CAV (Computer-Aided Verification) Fuel Injection System.</p> <p>(5 hours)</p>	<ol style="list-style-type: none"> <li>1. Describe Lucas CAV Fuel Supply Systems.</li> <li>2. Explain the operation of a CAV fuel supply pump.</li> <li>3. Describe CAV injection.</li> <li>4. Describe performance problems related to CAV Fuel Injection Systems.</li> </ol>	<p><b>Ready Practice:</b> 1, 4, 11</p> <p><b>CTE Anchor:</b> Problem Solving and Critical Thinking: 5.3 Technical Knowledge and Skills: 10.1</p> <p><b>CTE Pathway:</b> C1.5, C3.1, C3.6</p>
<p>J. GENERAL DIAGNOSIS AND REPAIR</p> <p>Understand, apply, and evaluate the general diagnostic and repair techniques for diesel engines according to the manufacturer's specifications</p> <p>(40 hours)</p>	<ol style="list-style-type: none"> <li>1. Inspect fuel, oil, and coolant levels, and condition; determine needed action. P-1</li> <li>2. Identify causes of engine fuel, oil, coolant, air, and other leaks; determine needed action. P-1</li> <li>3. Listen for engine noises; determine needed action. P-3</li> <li>4. Observe engine exhaust smoke color and quantity; determine needed action. P-3</li> <li>5. Identify causes of no cranking, cranks but fails to start, hard starting, and starts but does not continue to run problems; determine needed action. P-1</li> <li>6. Identify causes of surging, rough operation, misfiring, low power, slow deceleration, slow acceleration, and shutdown problems; determine needed action. P-1</li> <li>7. Identify engine vibration problems; determine needed action. P-2</li> <li>8. Check and record electronic diagnostic codes and trip/operational data; monitor electronic data; verify customer programmable parameters; clear codes; determine further diagnosis. P-1</li> </ol>	<p><b>Career Ready Practice:</b> 1, 2, 3, 5, 10</p> <p><b>CTE Anchor:</b> Technology: 4.1, 4.2, 4.3 Problem Solving and Critical Thinking: 5.1, 5.2, 5.3, 5.4 Responsibility and Flexibility: 7.4 Ethics and Legal Responsibilities: 8.1 Demonstration and Application: 11.2</p> <p><b>CTE Pathway:</b> C2.1, C2.2, C2.3, C2.4, C2.5, C2.6, C3.1, C4.1, C4.3, C5.6, C6.1, C6.2, C6.3, C6.4</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
<p>K. CYLINDER HEAD AND VALVE TRAIN</p> <p>Understand, apply, and evaluate the diagnostic, maintenance, and repair techniques for the cylinder head and valve train according to the manufacturer's specifications.</p> <p>(40 hours)</p>	<ol style="list-style-type: none"> <li>1. Remove, clean, inspect for visible damage, and replace cylinder head(s) assembly. P-1</li> <li>2. Clean and inspect threaded holes, studs, and bolts for serviceability; determine needed action. P-1</li> <li>3. Inspect cylinder head for cracks/damage; check mating surfaces for warpage; check condition of passages; inspect core/expansion and gallery plugs; determine needed action. P-1</li> <li>4. Disassemble head and inspect valves, guides, seats, springs, retainers, rotators, locks, and seals; determine needed action. P-3</li> <li>5. Measure valve head height relative to deck and valve face-to-seat contact; determine needed action. P-3</li> <li>6. Inspect injector sleeves and seals; measure injector tip or nozzle protrusion; determine needed action. P-3</li> <li>7. Inspect valve train components; determine needed action. P-1</li> <li>8. Reassemble cylinder head. P-3</li> <li>9. Inspect, measure, and replace/reinstall overhead camshaft; measure/adjust end play and backlash. P-2</li> <li>10. Inspect; determine needed action. P-1</li> <li>11. Inspect cam followers; determine needed action. P-2</li> <li>12. Adjust valve bridges (crossheads); adjust valve clearances and injector.</li> </ol>	<p><b>Career Ready Practice:</b> 1, 5, 10</p> <p><b>CTE Anchor:</b> Technology: 4.1, 4.2, 4.3 Problem Solving and Critical Thinking: 5.1, 5.2, 5.3, 5.4 Responsibility and Flexibility: 7.4 Ethics and Legal Responsibilities: 8.1 Demonstration and Application: 11.2</p> <p><b>CTE Pathway:</b> C2.1, C2.2, C2.3, C2.4, C2.5, C2.6, C3.1, C4.1, C4.3, C5.6, C6.1, C6.2, C6.3, C6.4</p>
<p>L. ENGINE BLOCK</p> <p>Understand, apply, and evaluate the diagnostic, maintenance, and repair techniques for the different types of air induction systems according to the manufacturer's specifications.</p>	<ol style="list-style-type: none"> <li>1. Perform crankcase pressure test; determine needed action. P-1</li> <li>2. Remove, inspect, service, and install pans, covers, gaskets, seals, wear rings, and crankcase ventilation components. P-2</li> <li>3. Disassemble, clean, and inspect engine block for cracks/damage; measure mating surfaces for warpage; check condition of passages, core/expansion and gallery plugs; inspect threaded holes, studs, dowel pins, and bolts for serviceability; determine needed action. P-2</li> <li>4. Inspect cylinder sleeve counterbore and lower bore; check bore distortion; determine needed action. P-2</li> <li>5. Clean, inspect, and measure cylinder walls or liners for wear and damage; determine needed action. P-2</li> <li>6. Replace/reinstall cylinder liners and seals; check and adjust liner height (protrusion). P-2</li> <li>7. Inspect in-block camshaft bearings for wear and damage; determine needed action. P-3</li> <li>8. Inspect, measure, and replace/reinstall in-block camshaft; measure/adjust end play. P-3</li> </ol>	<p><b>Career Ready Practice:</b> 1, 5, 10, 11</p> <p><b>CTE Anchor:</b> Technology: 4.1, 4.2, 4.3 Problem Solving and Critical Thinking: 5.1, 5.2, 5.3, 5.4 Responsibility and Flexibility: 7.4 Ethics and Legal Responsibilities: 8.1 Demonstration and Application: 11.2</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(45 hours)	<ol style="list-style-type: none"> <li>9. Clean and inspect crankshaft for surface cracks and journal damage; check condition of oil passages; check passage plugs; measure journal diameter; determine needed action. P-2</li> <li>10. Inspect main bearings for wear patterns and damage; replace as needed; check bearing clearances; check and correct crankshaft end play. P-2</li> <li>11. Inspect, install, and time gear train; measure gear backlash; determine needed action. P-2</li> <li>12. Inspect connecting rod and bearings for wear patterns; measure pistons, pins, retainers, and bushings; perform needed action. P-2</li> <li>13. Determine piston-to-cylinder wall clearance; check ring-to-groove fit and end gap; install rings on pistons. P-3</li> <li>14. Assemble pistons and connecting rods; install in block; install rod bearings and check clearances. P-2</li> <li>15. Check condition of piston cooling jets (nozzle); determine needed action. P-2</li> <li>16. Inspect and measure crankshaft vibration damper; determine needed action. P-3</li> <li>17. Install and align flywheel housing, inspect flywheel housing(s) to transmission housing/engine mating surface(s) and measure flywheel housing face and bore runout; determine needed action. P-3</li> <li>18. Inspect flywheel/flexplate (including ring gear) and mounting surfaces for cracks and wear; measure runout; determine needed action. P-2</li> </ol>	<p><b>CTE Pathway:</b> C2.1, C2.2, C2.3, C2.4, C2.5, C2.6, C3.1, C4.1, C4.3, C5.6, C6.1, C6.2, C6.3, C6.4</p>
<p>M. DIESEL ELECTRIC VEHICLES</p> <p>Understand and evaluate the basics of diesel electric vehicles.</p> <p>(2 hours)</p>	<ol style="list-style-type: none"> <li>1. Define the concept of diesel electric vehicles.</li> <li>2. Differentiate between a diesel electric vehicle and a vehicle powered by a diesel engine on the bases of: <ol style="list-style-type: none"> <li>a. engine size</li> <li>b. fuel economy</li> <li>c. emissions</li> </ol> </li> </ol>	<p><b>Ready Practice:</b> 1, 4</p> <p><b>CTE Anchor:</b> Technical Knowledge and Skills: 10.1</p> <p><b>CTE Pathway:</b> C1.5, C3.1, C3.6</p>
<p>N. EMPLOYABILITY SKILLS</p> <p>Understand, apply, and evaluate the employability skills required in diesel repair and maintenance.</p>	<ol style="list-style-type: none"> <li>1. Describe employer requirements for the following: <ol style="list-style-type: none"> <li>a. punctuality</li> <li>b. attendance</li> <li>c. attitude toward work</li> <li>d. quality of work</li> <li>e. teamwork</li> <li>f. responsibility</li> <li>g. timeliness</li> <li>h. communication skills</li> </ol> </li> </ol>	<p><b>Ready Practice:</b> 1, 2, 3, 5, 10, 11</p> <p><b>CTE Anchor:</b> Communications: 2.1, 2.2, 2.3, 2.4, 2.5 Career Planning and Management: 3.9</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(4 hours)	<ol style="list-style-type: none"> <li>2. Identify potential employers through traditional and internet sources.</li> <li>3. Design sample résumés.</li> <li>4. Describe the importance of filling out a job application legibly, with accurate and complete information.</li> <li>5. Complete sample job application forms correctly.</li> <li>6. Describe the importance of enthusiasm on a job.</li> <li>7. Describe the importance of appropriate appearance on a job.</li> <li>8. Describe the importance of the continuous upgrading of job skills.</li> <li>9. Describe customer service as a method of building permanent relationships between the organization and the customer.</li> </ol>	Responsibility and Flexibility: 7.2, 7.7 Ethics and Legal Responsibility: 8.4, 8.5 Leadership and Teamwork: 9.3  <b>CTE Pathway:</b> C5.4, C5.5

## ***SUGGESTED INSTRUCTIONAL MATERIALS and OTHER RESOURCES***

### **TEXTS AND SUPPLEMENTAL BOOKS**

Bell, Joseph. Modern Diesel Technology: Electricity and Electronics. Cengage Learning, 2006.

Bennett, Sean. Medium/Heavy Duty Truck Engines, Fuel and Computerized Management Systems. Cengage Learning, 2008.

Bosch, Robert GmbH. Diesel-Engine Management. Wiley, John and Sons, Incorporated, 2006.

Bosch, Robert GmbH. Electronic Diesel Control EDC. Bentley Publishers, 2001.

Dagel, John F., Robert N. Brady and John Dagel. Diesel Engine and Fuel System Repair. 5<sup>th</sup> Edition. (Hardcover). Prentice Hall, 2001.

Dempsey, Paul K. Troubleshooting and Repairing Diesel Engines. MacGraw-Hill Companies, 2007.

Dixon, John and Frank Dixon. Modern Diesel Technology: Heating, Ventilation, Air Conditioning and Refrigeration. Cengage Learning, 2006.

Duffy, James E. Modern Automotive Technology, 7<sup>th</sup> Edition. Goodheart-Willcox Publishing, 2009.

Norman, Andrew. Heavy Duty Truck Systems. 3<sup>rd</sup> Edition. Thomson Delmar Learning, 2000.

Norman, Andrew and John A. Corinchock. Diesel Technology: Fundamentals, Service, Repair. Goodheart-Willcox Publisher, November 2006.

Norman, Andrew, John A. Corinchock and Robert Scharff. Diesel Technology. Goodheart-Willcox Publisher, 2000.

Song, Chunshan. Chemistry of Diesel Fuel. CRC Press, 2000.

## **RESOURCES**

Employer Advisory Board members

Foundation Standards

<http://www.cde.ca.gov/ci/ct/sf/documents/transportation.pdf>

Automotive Retailing Today (ART) 8400 Westpark Dr., MS 2, McLean, VA 22102. Phone: (703) 556-8578.

Automotive Youth Educational Systems (AYES) 50 W. Big Beaver, Suite 145, Troy, MI 48084. Phone: (248) 526-1750. Fax: (248) 526-1751.

National Automobile Dealers Association (NADA) Public Relations Dept., 8400 Westpark Dr., McLean, VA 22102-3591. Phone: (703) 821-7000.

National Automotive Technicians Education Foundation (NATEF) 101 Blue Seal Dr. SE, Suite 101, Leesburg, VA 20175. Phone: (703) 669-6650. Fax: (703) 669-6125. [www.natef.org](http://www.natef.org)

[http://www.ed-foundation.org/html\\_pages/products\\_programs\\_services/natef\\_tools/non-structural\\_analysis/non-structural\\_analysis.shtml](http://www.ed-foundation.org/html_pages/products_programs_services/natef_tools/non-structural_analysis/non-structural_analysis.shtml)

National Institute for Automotive Service Excellence (ASE) 101 Blue Seal Dr. SE, Suite 101, Leesburg, VA 20175. Phone: (703) 669-6600.

SkillsUSA P.O. Box 3000, Leesburg, VA 20177-0300. Phone: (703) 777-8810. Fax: (703) 777-8999.  
[www.skillsusa.org](http://www.skillsusa.org)

## **COMPETENCY CHECKLIST**

## ***TEACHING STRATEGIES and EVALUATION***

### **METHODS AND PROCEDURES**

- A. Lecture and discussion
- B. Demonstration
- C. Multi-sensory presentations
- D. Lab and live shop work

### **EVALUATION**

SECTION A – Orientation and Safety – Pass the safety test with 100% accuracy.

SECTION B – Resource Management – Pass all assignments and exams on resource management with a minimum score of 80% or higher.

SECTION C – Trade Mathematics – Pass all assignments and exams on trade mathematics with a minimum score of 80% or higher.

SECTION D – Service Manuals and Computer-Based Information Systems – Pass all assignments and exams on service manuals and computer-based information systems with a minimum score of 80% or higher.

SECTION E – Tools and Equipment – Pass all assignments and exams on tools and equipment with a minimum score of 80% or higher.

SECTION F – Basic Principles of Diesel – Pass all assignments and exams on basic principles of diesel with a minimum score of 80% or higher.

SECTION G – Bosch Fuel Injection System – Pass all assignments and exams on Bosch fuel injection system with a minimum score of 80% or higher.

SECTION H – General Motors Fuel Injection System – Pass all assignments and exams on General Motors fuel injection system with a minimum score of 80% or higher.

SECTION I – Lucas CAV Fuel Injection System – Pass all assignments and exams on Lucas CAV fuel injection system with a minimum score of 80% or higher.

SECTION J – General Diagnosis and Repair – Pass all assignments and exams on general diagnosis and repair with a minimum score of 80% or higher.

SECTION K – Cylinder Head and Valve Train – Pass all assignments and exams on cylinder head and valve train with a minimum score of 80% or higher.

SECTION L – Engine Block – Pass all assignments and exams on engine block with a minimum score of 80% or higher.

SECTION M – Diesel Electric Vehicles – Pass all assignments and exams on diesel electric vehicles with a minimum score of 80% or higher.

SECTION N –Employability Skills – Pass all assignments and exams on employability skills with a minimum score of 80% or higher.

**NATEF Task List Priority Item Totals (by area)**

I. Diesel Engines

P-1 = 39

P-2 = 27

P-3 = 24

II. Drive Train

P-1 = 23

P-2 = 17

P-3 = 17

III. Brakes

P-1 = 30

P-2 = 14

P-3 = 10

IV. Suspension & Steering

P-1 = 23

P-2 = 11

P-3 = 11

V. Electrical/Electronic Systems

P-1 = 31

P-2 = 21

P-3 = 12

VI. Heating, Ventilation, & Air Conditioning

P-1 = 29

P-2 = 16

P-3 = 12

VII. Preventative Maintenance Inspection

P-1 = 145

P-2 = 0

P-3 = 0

VIII. Hydraulics

P-1 = 12

P-2 = 20

P-3 = 0

## DEFINITIONS OF TECHNICAL TERMS

ADJUST - to bring components to specified operational settings.

ALIGN - to restore the proper position of components.

ANALYZE - to assess the condition of a component or system.

ASSEMBLE (REASSEMBLE) - to fit together the components of a device or system.

BALANCE - to establish correct linear, rotational or weight relationship.

BLEED - to remove air from a closed system.

CAN – Controller Area Network. CAN is a network protocol (SAE J2284/ISO 15765-4) used to interconnect a network of electronic control modules

CHARGE - to bring to a specified state, e.g., battery or air conditioning system.

CHECK - to verify condition by performing an operational or comparative examination.

CLEAN - to rid component of foreign matter for the purpose of reconditioning, repairing, measuring or reassembling.

DEGLAZE – to remove a smooth glossy surface.

DETERMINE - to establish the procedure to be used to perform the necessary repair.

DETERMINE NECESSARY ACTION – indicates that the diagnostic routine(s) is the primary emphasis of a task. The student is required to perform the diagnostic steps and communicate the diagnostic outcomes and corrective actions required addressing the concern or problem. The training program determines the communication method (worksheet, test, verbal communication, or other means deemed appropriate) and whether the corrective procedures for these tasks are actually performed.

DIAGNOSE - to identify the cause of a problem.

DISASSEMBLE - to separate a component's parts as a preparation for cleaning, inspection or service.

DISCHARGE - to empty a storage device or system.

EVACUATE - to remove air, fluid or vapor from a closed system by use of a vacuum pump.

FLUSH - to internally clean a component or system.

HIGH VOLTAGE – voltages of 50 volts and higher.

HONE - to restore or resize a bore by using rotating cutting stones.

JUMP START - to use an auxiliary power supply to assist a battery to crank an engine.

LOCATE – to determine or establish a specific spot or area.

MEASURE - to determine existing dimensions/values for comparison to specifications.

NETWORK - a system of interconnected electrical modules or devices.

ON-BOARD DIAGNOSTICS (OBD) - diagnostic protocol which monitors computer inputs and outputs for failures.

PARASITIC DRAW - electrical loads which are still present when the ignition circuit is OFF.

PERFORM - to accomplish a procedure in accordance with established methods and standards.

PERFORM NECESSARY ACTION – indicates that the student is to perform the diagnostic routine(s) and perform the corrective action item. Where various scenarios (conditions or situations) are presented in a single task, at least one of the scenarios must be accomplished.

PURGE - to remove air or fluid from a closed system.

REMOVE - to disconnect and separate a component from a system.

REPAIR - to restore a malfunctioning component or system to operating condition.

REPLACE - to exchange a component; to reinstall a component.

RESURFACE – to restore correct finish.

SERVICE - to perform a procedure as specified in the owner's or service manual.

TEST - to verify condition through the use of meters, gauges or instruments.

TORQUE - to tighten a fastener to specified degree or tightness (in a given order or pattern if multiple fasteners are involved on a single component).

VERIFY - to confirm that a problem exists after hearing the customer's concern; or, to confirm the effectiveness of a repair.

VOLTAGE DROP - a reduction in voltage (electrical pressure) caused by the resistance in a component or circuit.

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Statement for Civil Rights

All educational and vocational opportunities are offered without regard to race, color, national origin, gender, or physical disability.

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